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The relationship between neurological impairment or brain damage and severe reading disability is investigated. Symptoms and causes of neurological impairment are listed, and reading disability theories are discussed. Smith and Carrigan offer a neurochemical explanation of reading disability based on synaptic transmission problems. Orton, Dearborn, and Delacato point to a relationship between reading disability and lateral dominance. However, the paper quickly notes that none of the mentioned theories have been supported by empirical data. Some helpful psychological tests for the identification of neurological defects are listed. It is pointed out that there is no sure way to diagnose neurological causes and that teachers must rely primarily on a pattern of symptoms when making neurological referrals. General labels such as "dyslexia" and "congenital word blindness" are seen as confusing the issue and as creating a matter of concern. A bibliography is included. (RT)

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Diagnosis in Severe Reading Disability

According to Smith and Carrigan (25), severely retarded readers are characterized by severe blending deficiency, abnormally low reading rate on familiar material, and deficient discrimination of sounds and visual symbols.

Diagnosis of the severely retarded reader cannot, of course, stop with a categorizing of disclosed symptoms. It must concern itself with the causation of the difficulty.

Depending on their diagnostic prejudice, reading specialists find different reasons for severe reading retardation. Some are prone to stress a single cause and minimize or exclude all others. (29) This practice continues even though one of the most definitive research studies on causation of reading disability lends little support to the contention that single factors are responsible for severe reading problems. Robinson states:

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> ... the pupils who were seriously retarded in reading also exhibited the greatest number of anomalies, whereas those least retarded presented fewest. (22)

In recent years, it has become increasingly popular to place heavy emphasis on neurological impairment as a cause of reading disability. Of the various neurological theories cited, brain damage or impairment has been popular as an etiological factor.

There is no doubt that destruction of cerebral tissue can, in some cases, cause loss of reading ability. Dittner, Davis, and Smith (5), for example, cite a case of fifty-year-old navy officer who, after an accident, lost his ability to read. He was able to write, however, and showed no other difficulties in the language area. Medical annals are replete with cases of reading inability stemming from apoplectic strokes which cause lesions in the visual center of the brain. Hinshelwood (15), an English ophthalmologist, designated the condition as "acquired word blindness" or "alexia." Because Hinshelwood encountered severe reading disability in children with symptoms resembling those of acquired word blindness, he hypothecated the existence of a congenital variety of alexia. This abnormal condition, he felt, could be the result of birth injuries, faulty development, or disease involving the angular or supra-marginal gyri on the side of the dominant hemisphere.

The belief that word blindness stems from an abnormality of a localized area of the brain isn't conclusive. Hallgren (13) is of the opinion that reading difficulty resulting from a localized lesion in the dominant hemisphere is exceedingly rare. Goldstein (12) views every mental performance as a mental

process which concerns the entire cortex.

Gesell emphasizes birth in injury as an important factor in reading disability. He states:

> The surprising prevalence of reading disabilities, so-called, and their frequent association with minimal birth injuries tends to support our thesis that these injuries are more common than is ordinarily supposed. (11)

Supportive of Gesell's views, several studies report EEG abnormalities appearing frequently in children with reading disability. (16,17)

Contrary to the opinions of the foregoing theorists and researchers, a number of today's leading reading specialists, including Bond, Spache, & Tinker, feel that there is an over-emphasis upon neurological impairment as a cause of reading disability.

Medical Designations

The rather technical vocabulary employed by a number of today's medical writers in describing severe reading disability is a matter of concern. For example, Herman (14) employs the terms "congenital word blindness" and "congenital alexia." Spache is dubious about the use of these labels. He states:

> The group is clearly identified in Dr. Herman's mind despite his recognition that there is not'one symptom nor one straight forward objective finding on which to base the descripton.' (27)

Similarily, Money (19), editor of a series of papers, uses the terms "specific reading disability" or "dyslexia" in referring to certain children with severe reading disability. Spache questions the validity of such a designation by stating:

> It is diffucult for this reviewer to recognize clearly the small group of severely retarded readers who are assumed to be dyslexic. This is particulary true since, as repeated frequently in these papers, there is not a single, consistent symptom of reading behavior which distinguishes the syndrome called "specific reading disability" from among the clinical population of severely retarded readers. (28)

Symptoms of Neurological Impairment

Symptoms of neurological impairment with which reading specialists should be familiar are:

1. Awkwardness, clumsiness, or poor coordination when walking, running, writing, etc.
2. Difficulties in sucking or swallowing.
3. Delayed speech or articulation difficulties.
4. Paralysis or weakness of the extremities.
5. Abnormalities of the head.
6. Persistent headaches.
7. Convulsive seizures or lapses in consciousness.
8. Overactivity and concentration difficulties.

(3) Causes of Neurological Impairment

Causes of neurological impairment with which reading specialists should be acquainted are (23):

1. Familial neurological dysfunction.
2. Congenital defects of the central nervous system.
3. Complications of pregnancy.
   a. German measles, mumps, virus pneumonia, scarlet fever, and encephalitis.
   b. Rh incompatibility.
   c. Toxemia.
   d. Threatened abortion.
4. Complications of birth or labor.
   a. Caesarean section.
   b. Premature birth.
   c. Prolonged labor--breech presentation, high forceps delivery.

5. Childhood diseases.
   a. Encephalitis (particulary measles encephalitis)
   b. Meningitis.
   c. High fever with delirium.

6. Head injury involving unconsciousness (particulary before the age of three.)

7. Miscellaneous.
   a. Poisons resulting in unconsciousness.
   b. Burns involving large areas of the body surface.
   c. Excessive crying or head banging during the first year of life.

A Neurochemical Theory

One of the most intriguing and provocative studies in recent years was carried out by Smith and Carrigan (26) who offer a neurochemical explanation of synaptic transmission problems which they feel relate to severe reading disability.

To make normal neural transmission possible, a delicate balance between two substances--acetylcholine (ACh) and cholinesterase (ChE)-- is essential. (Ach) is needed if an impulse is to bridge the junction (synapse) between neurons. Repetitive firing of a neuron continues until (Ach) is neutralized by (ChE). The latter, it appears, acts as a circuit breaker.

Smith and Carrigan contend that an overabundance of (ACh) makes it difficult for an individual to change his fixation point. This, in turn, results in slow reading and an inability to blend phonemes. Too much (ChE*, on the other hand, makes it difficult for an individual to sustain fixation and brings about rapid shifts in attention. When this condition exists inaccurate reading characterized by substitution of one sound for another results.

Smith and Carrigan identified endocrine disorders as having a bearing on synaptic transmission and neural activity. In a number of experiments, a variety of medications were prescribed to correct metabolic as well as synaptic abnormalities. Involved were vitamins, hormones, stimulants and tranquilizers. Unfortunately, groups that received treatment did not make statistically significant gains. At the present time the organic approach to reading difficulties advocated by Smith and Carrigan remains unproved.

Lateral Dominance

Lateral dominance refers to the consistent choice or superior functioning of one side of the body over the other. This is believed to result from a dominant hemisphere which is on the side opposite the so-called preferred hand or foot. Most individuals are dextrads--that is, they prefer their right hand; a few individuals are sinistrads and primarily use their left hand. In addition to handedness, most individuals have a dominant eye, one preferred for sighting, looking through a microscope, etc. Approximately a third of the population is mixed in dominance.

One of the earliest theorists in this area was Orton. Orton was a neurologist who believed memory traces (engrams) that are found in the dominant hemisphere are involved in making symbolic associations. (20) Engrams in the non-dominant hemisphere, he reasoned, are mirrored images of the former, and ordinarily are ignored in the language process. Should, however, there be a dominance problem (ambidexterity is an example) the mirrored engrams evince themselves in the form of reversals. Orton referred to the resulting condition as

"strephosymbolia" meaning twisted symbols. According to Bond and Tinker (4), Orton's theory is generally accepted by neurologists but not by most psychologists.

Another theory based on the dominance factor was promulgated by Dearborn. Dearborn (6) stated that movements away from the center of the body are more easily made than those in the opposite direction. Since writing and reading involve left to right progressions, right-handed and right-eyed individuals would find it easier to read. Left-handed individuals and those with a mixed or inconsistent preference for either side would more likely experience confusion.

More recently, Delacato (7,8) set forth a neuro-psychological approach to reading disability. He places great emphasis on laterality and employs eye occlusion, use of only the dominant hand, and elimination of all tonal activity. Delacato believes that development proceeds in an organized and sequential fashion in the nervous system, progressing through the medulla and cord, pons, midbrain, and cortex, and culminating in hemispheric dominance. Accordingly, an individual's mobility patterns, vision, audition, and language are related to his anatomical development.

The popular press has given the neuro-psychological approach favorable publicity. Medical and psychological publications, however, have not been as enthusiastic. A well designed study by Robbins (21) found no statistically significant relationship between neurological organization as measured by creeping and crawling patterns and reading achievement.

Although the role played by dominance in reading disability is controversial, the majority of investigations indicate little or no relationship between the two. Notable among these are Anderson (1), Flax (9), Gates (10), Vernon (31), and Witty (32).

What dominance enthusiasts seem to overlook is that anatomically, eye preference and handedness are unrelated. (2,24) Although nerve fibers pass from the hands to the opposite hemispheres of the brain, nerve fiber pathways from the eyes follow a different pattern. When these fibers pass through the optic chiasma, they decussate. Thus an individual's right and left eyes are controlled by both hemispheres and conflicts between eye and hand are not possible.

Helpful Psychological Tests

If a child's developmental history or behavior indicates possible neurological impairment, he should be referred for a neurological examination. A number of psychologocial tests are also helpful in uncovering neurological defects. Many of these tests involve items or subtests of the Stanford-Binet and/or Wechsler Intelligence Scale for Children. Included in these are Repetition of Digits, Copying a Diamond, Kohs Block Design, Memory for Designs, Object Assembly, Coding or Digit Symbol. Additional tests include the Goodenough Draw-a-Man Test, Bender Visual Motor Gestalt, Archimedes Spiral Test, Ellis Visual Designs, Knox Cube Test, Peabody Picture Vocabulary Test, and others as preferred by the psychologist involved.

Learning Methods Test

Since children with serious reading disability may learn more easily and rapidly through one sensory mode than another, diagnostic techniques for uncovering these differences should be employed. The Learning Methods Test devised by Robert E. Mills (18) measures a child's aptitude to profit by an auditory, kinesthetic, visual, or a combined method. This is done by exposing the child to a series of trial lessons in word recognition. Although the Language Methods Test must be administered over a period of five days, it is a most useful adjunct to reading diagnosis.

Summary

In spite of the many suppositions, theories, and investigations, the relationship between neurological impairment or brain damage and severe reading disability remains undetermined. A number of leading authorities in reading believe that neurological impairment is seldon if ever a cause of reading disability. The contention that neurological impairment is a major cause of reading problems is without support at the present time. Although psychological tests are helpful, there is no sure or fool-proof way to diagnose neurological causes. Teachers must rely primarily on a pattern of symptoms when making neurological referrals. Impressive labels such as "dyslexia" and "congenital word blingness" confuse the issue since there is no apparent agreement as to the symptomotology characterizing the groups so designated. The contention that mixed hand-eye dominance is a factor in severe reading disability will find the Mill's Learning Methods

Test helpful in determining the particular sensory mode through which a given child can learn most efficiently.

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